

JEE MAIN 2020 · QUESTION PAPER

4 Sep 2020 **Shift 1**

70 questions in exam order, with answer key

Subject	Section A multiple choice	Section B numerical value
● Physics	19 Q1 to Q19	3 Q20 to Q22
● Chemistry	20 Q23 to Q42	5 Q43 to Q47
● Mathematics	18 Q48 to Q65	5 Q66 to Q70
In this PDF	70 questions · answer key at the end	

- 1 Set a 3 hour timer and attempt the paper in one sitting, like the real exam.
- 2 Check yourself against the answer key at the end. Every question names its chapter, so you can see where marks went.
- 3 Got one wrong? Tap “Step-by-step solution” at the top right of it for the full working, where available.

Attempt this paper online

The same questions in the same order, with instant answer checking and step-by-step solutions where available.

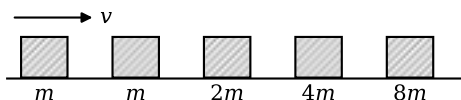
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Answers follow NTA's final answer keys. Typing errors are possible, so check doubtful answers against the official key. Spotted a mistake? prepwise.in/feedback · Terms: prepwise.in/terms

Q1 Collision

[Step-by-step solution](#) · prepwisar.in/questions/sCFZVA5pgC

Blocks of masses m , $2m$, $4m$ and $8m$ are arranged in a line on a frictionless floor. Another block of mass m , moving with speed v along the same line (see figure) collides with mass m in perfectly inelastic manner. All the subsequent collisions are also perfectly inelastic. By the time the last block of mass $8m$ starts moving the total energy loss is $p\%$ of the original energy. Value of ' p ' is close to:



- (A) 37 (B) 77 (C) 87 (D) 94

Q2 Current Electricity

[Step-by-step solution](#) · prepwisar.in/questions/8uvogUSA5P

A battery of 3.0 V is connected to a resistor dissipating 0.5 W of power. If the terminal voltage of the battery is 2.5 V , the power dissipated within the internal resistance is:

- (A) 0.50 W (B) 0.072 W (C) 0.10 W (D) 0.125 W

Q3 Collision

[Step-by-step solution](#) · prepwisar.in/questions/CUjPQQ8f69

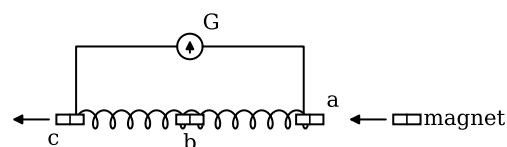
Particle A of mass $m_A = \frac{m}{2}$ moving along the x -axis with velocity v_0 collides elastically with another particle B at rest having mass $m_B = \frac{m}{3}$. If both particles move along the x -axis after the collision, the change $\Delta\lambda$ in de-Broglie wavelength of particle A, in terms of its de-Broglie wavelength (λ_0) before collision is:

- (A) $\Delta\lambda = \frac{5}{2}\lambda_0$ (B) $\Delta\lambda = \frac{3}{2}\lambda_0$ (C) $\Delta\lambda = 2\lambda_0$ (D) $\Delta\lambda = 4\lambda_0$

Q4 Electromagnetic Induction

[Step-by-step solution](#) · prepwisar.in/questions/el_JFLUqHI

A small bar magnet is moved through a coil at constant speed from one end to the other. Which of the following series of observations will be seen on the galvanometer G attached across the coil?



Three positions shown describe:

- (a) the magnet's entry
(b) magnet is completely inside and
(c) magnet's exit.

- (A) (a) → (b) → (c)
(B) (a) → (b) → (c)
(C) (a) → (b) → (c)
(D) (a) → (b) → (c)

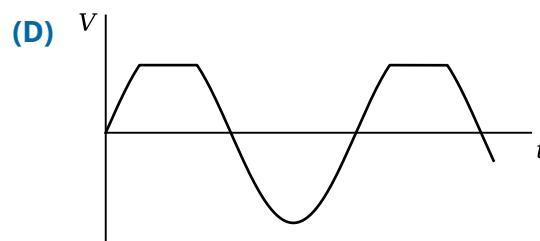
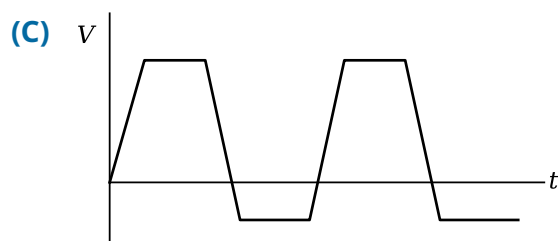
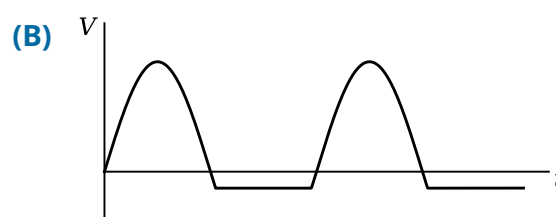
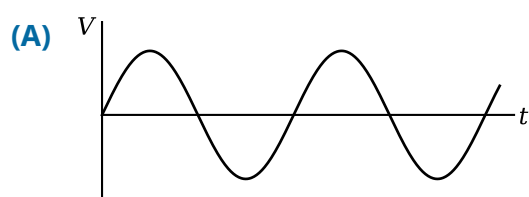
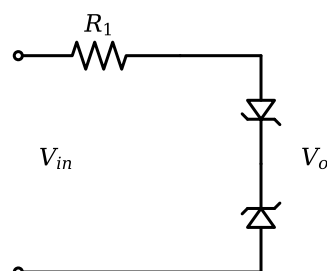
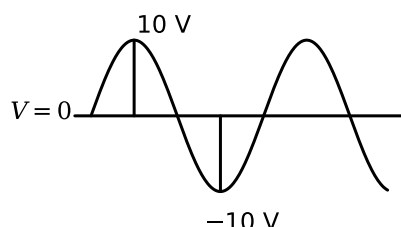
Q5 Electromagnetic Waves

[Step-by-step solution](#) · prepwisar.in/questions/CGYySG7fZW

Choose the correct option relating wave lengths of different parts of electromagnetic wave spectrum:

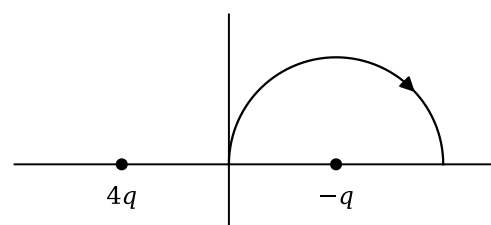
- (A) $\lambda_{\text{radio waves}} > \lambda_{\text{micro waves}} > \lambda_{\text{visible}} > \lambda_{\text{x-rays}}$ (B) $\lambda_{\text{visible}} > \lambda_{\text{x-rays}} > \lambda_{\text{radio waves}} > \lambda_{\text{micro waves}}$
(C) $\lambda_{\text{visible}} < \lambda_{\text{micro waves}} < \lambda_{\text{radio waves}} < \lambda_{\text{x-rays}}$ (D) $\lambda_{\text{x-rays}} < \lambda_{\text{micro waves}} < \lambda_{\text{radio waves}} < \lambda_{\text{visible}}$

Take the breakdown voltage of the zener diode used in the given circuit as 6V.
For the input voltage shown in figure below,
the time variation of the output voltage is:
(Graphs drawn are schematic and not to scale)



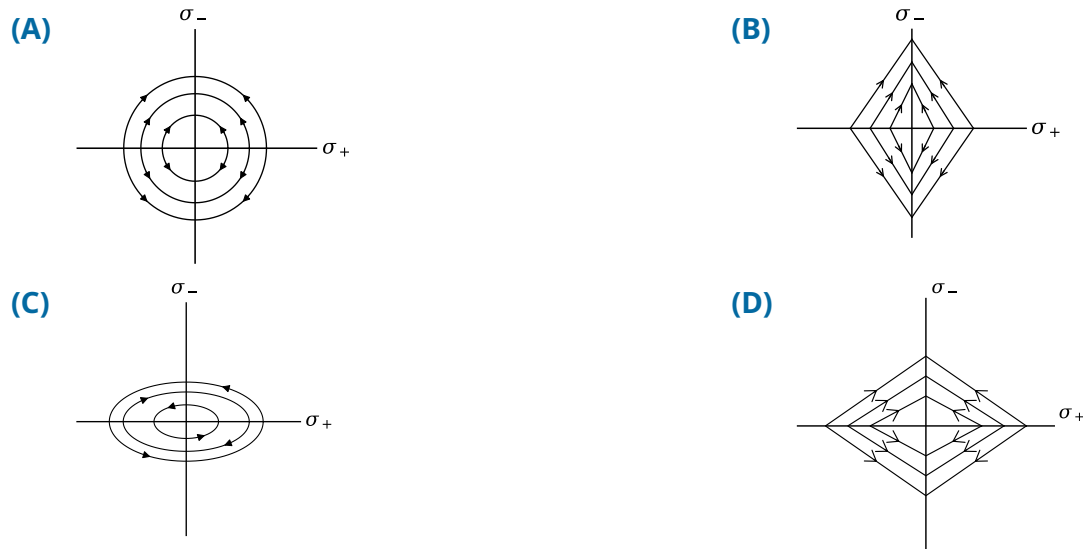
A two point charges $4q$ and $-q$ are fixed on the x -axis at $x = -\frac{d}{2}$ and $x = \frac{d}{2}$ respectively. If a third point charge ' q ' is taken from the origin to $x = d$ along the semicircle as shown in the figure, the energy of the charge will:

- (A) increase by $\frac{3q^2}{4\pi\epsilon_0 d}$ (B) increase by $\frac{2q^2}{3\pi\epsilon_0 d}$
(C) decrease by $\frac{q^2}{4\pi\epsilon_0 d}$ (D) decrease by $\frac{4q^2}{3\pi\epsilon_0 d}$



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Two charged thin infinite plane sheets of uniform surface charge density σ_+ and σ_- , where $|\sigma_+| > |\sigma_-|$, intersect at right angle. Which of the following best represents the electric field lines for this system:



On the x-axis and at a distance x from the origin, the gravitational field due a mass distribution is given by $\frac{Ax}{(x^2 + a^2)^{3/2}}$ in the x-direction. The magnitude of gravitational potential on the x-axis at a distance x, taking its value to be zero at infinity, is:

- (A) $A(x^2 + a^2)^{3/2}$ (B) $A(x^2 + a^2)^{1/2}$ (C) $\frac{A}{(x^2 + a^2)^{1/2}}$ (D) $\frac{A}{(x^2 + a^2)^{3/2}}$

Match the $\frac{C_p}{C_v}$ ratio for ideal gases with different type of molecules:

Molecule Type	C_p/C_v
(A) Monatomic	(I) 7/5
(B) Diatomic rigid molecules	(II) 9/7
(C) Diatomic non-rigid molecules	(III) 4/3
(D) Triatomic rigid molecules	(IV) 5/3

- (A) (A)-(III), (B)-(IV), (C)-(II), (D)-(I) (B) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
 (C) (A)-(IV), (B)-(I), (C)-(II), (D)-(III) (D) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

The specific heat of water = $4200 \text{ J kg}^{-1} \text{ K}^{-1}$ and the latent heat of ice = $3.4 \times 10^5 \text{ J kg}^{-1}$. 100 grams of ice at 0°C is placed in 200 g of water at 25°C . The amount of ice that will melt as the temperature of water reaches 0°C is close to (in grams):

- (A) 63.8 (B) 61.7 (C) 69.3 (D) 64.6

Q12 Magnetism & Matter[Step-by-step solution](https://www.prepwisar.in/questions/01WODrhdf2) > prepwisar.in/questions/01WODrhdf2

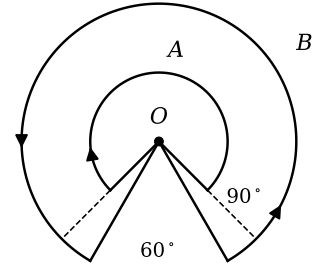
A small bar magnet placed with its axis at 30° with an external field of 0.06 T experiences a torque of 0.018 Nm . The minimum work required to rotate it from its stable to unstable equilibrium position is:

- (A) $6.4 \times 10^{-2}\text{ J}$ (B) $9.2 \times 10^{-3}\text{ J}$ (C) $7.2 \times 10^{-2}\text{ J}$ (D) $11.7 \times 10^{-3}\text{ J}$

Q13 Moving Charges & Magnetism[Step-by-step solution](https://www.prepwisar.in/questions/B-SFe_2ozH) > prepwisar.in/questions/B-SFe_2ozH

A wire A, bent in the shape of an arc of a circle, carrying a current of 2 A and having radius 2 cm and another wire B, also bent in the shape of arc of a circle, carrying a current of 3 A and having radius of 4 cm , are placed as shown in the figure. The ratio of the magnetic fields due to the wires A and B at the common centre O is:

- (A) $4 : 6$ (B) $6 : 4$ (C) $2 : 5$ (D) $6 : 5$

**Q14** Rectilinear Motion[Step-by-step solution](https://www.prepwisar.in/questions/iVIFeVIMQ9) > prepwisar.in/questions/iVIFeVIMQ9

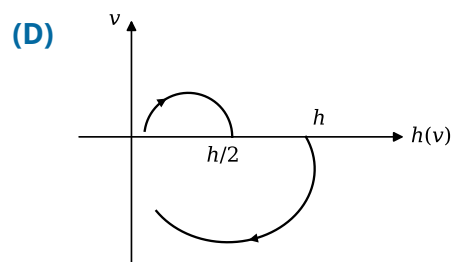
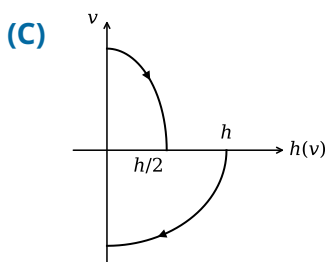
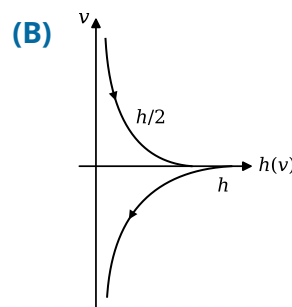
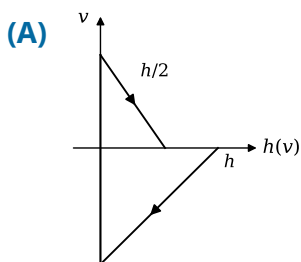
Starting from the origin at time $t = 0$, with initial velocity $5\hat{j}\text{ ms}^{-1}$, a particle moves in the x-y plane with a constant acceleration of $(10\hat{i} + 4\hat{j})\text{ ms}^{-2}$. At time t , its coordinates are $(20\text{ m}, y_0\text{ m})$. The values of t and y_0 are, respectively:

- (A) 5 s and 25 m (B) 2 s and 18 m (C) 2 s and 24 m (D) 4 s and 52 m

Q15 Rectilinear Motion[Step-by-step solution](https://www.prepwisar.in/questions/b0o8jr7e5Q) > prepwisar.in/questions/b0o8jr7e5Q

A Tennis ball is released from a height h and after freely falling on a wooden floor it rebounds and reaches height $\frac{h}{2}$. The velocity versus height of the ball during its motion may be represented graphically by:

(graph are drawn schematically and on not to scale)



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Q16 Fluid Mechanics[Step-by-step solution](https://www.prepwisar.in/questions/KVUhDkRg9V)

A air bubble of radius 1 cm in water has an upward acceleration 9.8 cm s^{-2} . The density of water is 1 gm cm^{-3} and water offers negligible drag force on the bubble. The mass of the bubble is (g = 980 cm/s^2).

- (A) 1.52 gm (B) 4.51 gm (C) 3.15 gm (D) 4.15 gm

Q17 Wave Optics[Step-by-step solution](https://www.prepwisar.in/questions/VnoqZ9ab1_)

A beam of plane polarised light of large cross-sectional area and uniform intensity of 3.3 Wm^{-2} falls normally on a polariser (cross sectional area $3 \times 10^{-4} \text{ m}^2$) which rotates about its axis with an angular speed of 31.4 rad/s . The energy of light passing through the polariser per revolution, is close to:

- (A) $1.0 \times 10^{-5} \text{ J}$ (B) $1.0 \times 10^{-4} \text{ J}$ (C) $1.5 \times 10^{-4} \text{ J}$ (D) $5.0 \times 10^{-4} \text{ J}$

Q18 Mechanical Waves[Step-by-step solution](https://www.prepwisar.in/questions/6aPWOSIY-g)

For a transverse wave travelling along a straight line, the distance between two peaks (crests) is 5 m, while the distance between one crest and one trough is 1.5 m. The possible wavelengths (in m) of the are:

- (A) 1, 3, 5, ... (B) $\frac{1}{1}, \frac{1}{3}, \frac{1}{5}, \dots$ (C) 1, 2, 3, ... (D) $\frac{1}{2}, \frac{1}{4}, \frac{1}{6}, \dots$

Q19 Units, Dimensions & Errors[Step-by-step solution](https://www.prepwisar.in/questions/-IDI8NEWng)

Dimensional formula for thermal conductivity is (here K denotes the temperature):

- (A) $\text{MLT}^{-3}\text{K}^{-1}$ (B) $\text{MLT}^{-2}\text{K}^{-2}$ (C) MLT^{-2}K (D) MLT^{-3}K

Physics Section B · Numerical value

Q20 to Q22

Q20 Ray Optics **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/wMtnrpjLab)

In a compound microscope, the magnified virtual image is formed at a distance of 25 cm from the eye-piece. The focal length of its objective lens is 1 cm. If the magnification is 100 and the tube length of the microscope is 20 cm, then the focal length of the eye-piece lens (in cm) is _____. (Round off to the nearest integer)

Q21 Kinetic Theory of Gases **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/BArBqz9KNN)

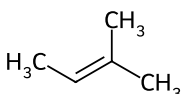
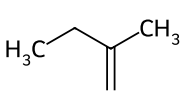
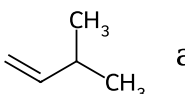
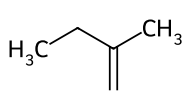
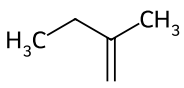
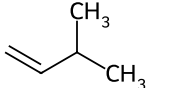
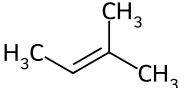
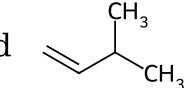
A closed vessel contains 0.1 mole of a monoatomic ideal gas at 200 K. If 0.05 mole of the same gas at 400 K is added to it, the final equilibrium temperature (in K) of the gas in the vessel will be close to _____. (Round off to the nearest integer)

Q22 Rotational Motion **NUMERICAL**[Step-by-step solution](https://www.prepwisar.in/questions/k2VzBALqIL)

A circular disc of mass M and radius R is rotating about its axis with angular speed ω_1 . If another stationary disc having radius $\frac{R}{2}$ and same mass M is dropped co-axially on to the rotating disc. Gradually both discs attain constant angular speed ω_2 the energy lost in the process is p% of the initial energy. Value of p is _____.

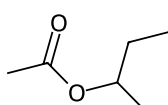
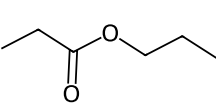
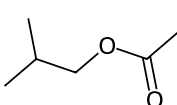
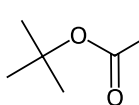
Q23 Alcohols, Phenols & Ethers[Step-by-step solution > prepwiser.in/questions/8hAkml0iTY](https://www.prepwiser.in/questions/8hAkml0iTY)

When neopentyl alcohol is heated with an acid, it slowly converted into an 85 : 15 mixture of alkenes A and B, respectively. What are these alkenes?

- (A)  and  (B)  and 
- (C)  and  (D)  and 

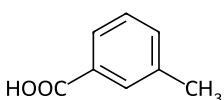
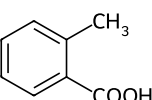
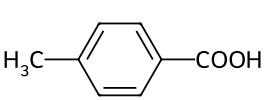
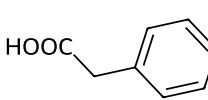
Q24 Alcohols, Phenols & Ethers[Step-by-step solution > prepwiser.in/questions/l-mBXgijYQR](https://www.prepwiser.in/questions/l-mBXgijYQR)

An organic compound (A) (molecular formula $C_6H_{12}O_2$) was hydrolysed with dil. H_2SO_4 to give a carboxylic acid (B) and an alcohol (C). 'C' gives white turbidity immediately when treated with anhydrous $ZnCl_2$ and conc. HCl . The organic compound (A) is:

- (A)  (B)  (C)  (D) 

Q25 Hydrocarbons: Aromatic (Arenes)[Step-by-step solution > prepwiser.in/questions/dKbZAqRHPq](https://www.prepwiser.in/questions/dKbZAqRHPq)

[P] on treatment with $Br_2/FeBr_3$ in CCl_4 produced a single isomer $C_8H_7O_2Br$ while heating [P] with sodalime gave toluene. The compound [P] is

- (A)  (B)  (C)  (D) 

Q26 Carbohydrates & Biomolecules[Step-by-step solution > prepwiser.in/questions/JUIJxc40_C](https://www.prepwiser.in/questions/JUIJxc40_C)

What are the functional groups present in the structure of maltose?

- (A) One acetal and one ketal (B) One ketal and one hemiketal
(C) Two acetals (D) One acetal and one hemiacetal

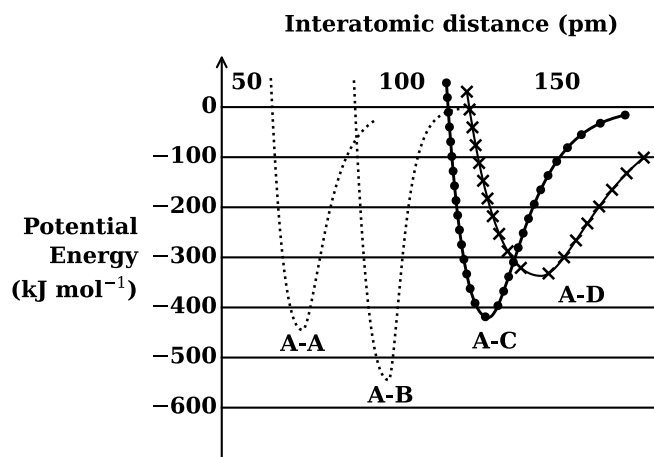
Q27 Amines & Diazonium Salts[Step-by-step solution > prepwiser.in/questions/tbUxSPYBRf](https://www.prepwiser.in/questions/tbUxSPYBRf)

Which of the following will react with $CHCl_3 + alc. KOH$?

- (A) Adenine and thymine (B) Thymine and proline
(C) Adenine and lysine (D) Adenine and proline

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The intermolecular potential energy for the molecules A, B, C and D given below suggests that:



- (A) A-B has the stiffest bond
(B) A-D has the shortest bond length
(C) A-A has the largest bond enthalpy
(D) D is more electronegative than other atoms

The number of isomers possible for $[\text{Pt}(\text{en})(\text{NO}_2)_2]$ is:

- (A) 3 (B) 1 (C) 4 (D) 2

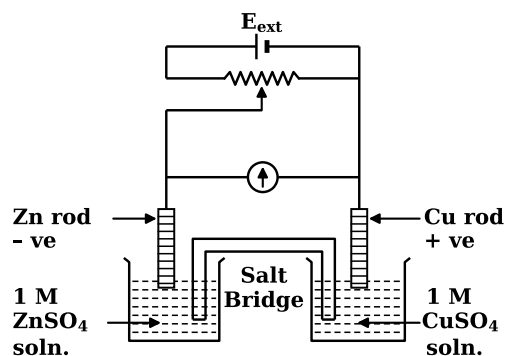
The pair in which both the species have the same magnetic moment (spin only) is:

- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{CoCl}_4]^{2-}$
(B) $[\text{Co}(\text{OH})_4]^{2-}$ and $[\text{Fe}(\text{NH}_3)_6]^{2+}$
(C) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cr}(\text{H}_2\text{O})]^{2+}$
(D) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

The elements with atomic numbers 101 and 104 belong to, respectively:

- (A) Group 6 and Actinoids
(B) Actinoids and Group 4
(C) Group 11 and Group 4
(D) Actinoids and Group 6

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$$E_{Cu^{2+}|Cu}^0 = +0.34 \text{ V}$$

$$E_{Zn^{2+}|Zn}^0 = -0.76 \text{ V}$$

Identify the incorrect statement from the option below for the above cell:

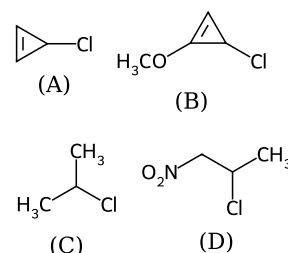
- (A) If $E_{\text{ext}} < 1.1 \text{ V}$, Zn dissolves at anode and Cu deposits at cathode
 (B) If $E_{\text{ext}} = 1.1 \text{ V}$, no flow of e^- or current occurs
 (C) If $E_{\text{ext}} > 1.1 \text{ V}$, e^- flows from Cu to Zn
 (D) If $E_{\text{ext}} > 1.1 \text{ V}$, Zn dissolves at Zn electrode and Cu deposits at Cu electrode

Q33 Halogen Derivatives: Haloalkanes & Haloarenes

Step-by-step solution > prepwiser.in/questions/0s-Knu5ZaH

The decreasing order of reactivity of the following organic molecules towards AgNO_3 solution is:

- (A) (B) > (A) > (C) > (D) (B) (A) > (B) > (C) > (D)
 (C) (A) > (B) > (D) > (C) (D) (C) > (D) > (A) > (B)



Q34 Metallurgy

Step-by-step solution > prepwiser.in/questions/dQvmk1JenT

Among statements (a) - (d), the correct ones are

- (a) Lime stone is decomposed to CaO during the extraction of iron from its oxides.
 (b) In the extraction of silver, silver is extracted as an anionic complex.
 (c) Nickel is purified by Mond's process.
 (d) Zr and Ti are purified by Van Arkel method.

- (A) (a), (c) and (d) only (B) (c) and (d) only (C) (b), (c) and (d) only (D) (a), (b), (c) and (d)

Q35 Redox Reactions

Step-by-step solution > prepwiser.in/questions/N0I5UL1Fa3

On heating, lead (II) nitrate gives a brown gas (A). The gas (A) on cooling changes to a colourless solid/liquid (B). (B) on heating with NO changes to a blue solid (C). The oxidation number of nitrogen in solid (C) is:

- (A) +3 (B) +4 (C) +5 (D) +2

Q36 Periodic Table & Periodicity

Step-by-step solution > prepwiser.in/questions/mx2GHy4clU

The ionic radii of O^{2-} , F^- , Na^+ and Mg^{2+} are in the order:

- (A) $\text{F}^- > \text{O}^{2-} > \text{Na}^+ > \text{Mg}^{2+}$ (B) $\text{Mg}^{2+} > \text{Na}^+ > \text{F}^- > \text{O}^{2-}$
 (C) $\text{O}^{2-} > \text{F}^- > \text{Mg}^{2+} > \text{Na}^+$ (D) $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+}$

On combustion of Li, Na and K in excess of air, the major oxides formed, respectively, are:

- (A) Li_2O , Na_2O_2 and K_2O (B) Li_2O_2 , Na_2O_2 and K_2O_2
 (C) Li_2O , Na_2O_2 and KO_2 (D) Li_2O , Na_2O and K_2O_2

The region in the electromagnetic spectrum where the Balmer series lines appear is:

- (A) Microwave (B) Ultraviolet (C) Visible (D) Infrared

Match the following:

- (A) (i)-(e), (ii)-(c), (iii)-(a), (iv)-(f) (B) (i)-(d), (ii)-(b), (iii)-(a), (iv)-(e)
 (C) (i)-(d), (ii)-(b), (iii)-(e), (iv)-(f) (D) (i)-(b), (ii)-(c), (iii)-(e), (iv)-(d)

(i) Foam	(a) smoke
(ii) Gel	(b) cell fluid
(iii) Aerosol	(c) jellies
(iv) Emulsion	(d) rubber
	(e) froth
	(f) Milk

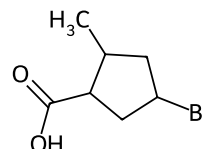
For one mole of an ideal gas, which of these statements must be true?

- (a) U and H each depends only on temperature
 (b) Compressibility factor z is not equal to 1
 (c) $C_{P,m} - C_{V,m} = R$
 (d) $dU = C_V dT$ for any process

- (A) (a), (c) and (d) (B) (a) and (c) (C) (c) and (d) (D) (b), (c) and (d)

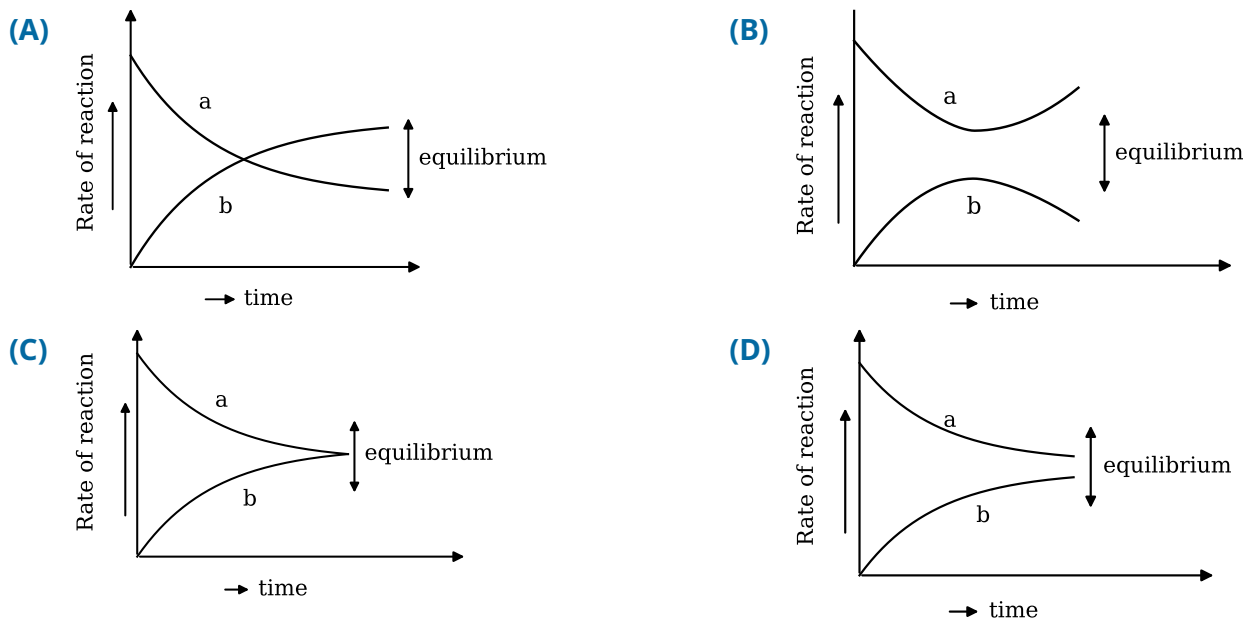
The IUPAC name of the following compound is:

- (A) 3-Bromo-5-methylcyclopentane carboxylic acid
 (B) 3-Bromo-5-methylcyclopentanoic acid
 (C) 4-Bromo-2-methylcyclopentane carboxylic acid
 (D) 5-Bromo-3-methylcyclopentanoic acid



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For the equilibrium $A \rightleftharpoons B$, the variation of the rate of the forward (a) and reverse (b) reaction with time is given by:



Chemistry Section B · Numerical value

Q43 to Q47

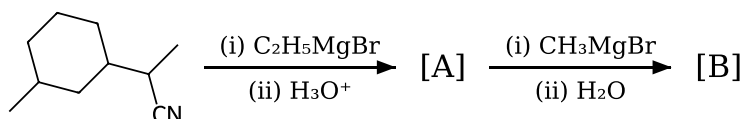
If 75% of a first order reaction was completed in 90 minutes, 60% of the same reaction would be completed in approximately (in minutes) _____.
(Take : $\log 2 = 0.30$; $\log 2.5 = 0.40$)

At 300 K, the vapour pressure of a solution containing 1 mole of n-hexane and 3 moles of n-heptane is 550 mm of Hg. At the same temperature, if one more mole of n-heptane is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. What is the vapour pressure in mm Hg of n-heptane in its pure state _____?

A 20.0 mL solution containing 0.2 g impure H_2O_2 reacts completely with 0.316 g of $KMnO_4$ in acid solution. The purity of H_2O_2 (in %) is _____.
(mol. wt. of $H_2O_2 = 34$; mol. wt. of $KMnO_4 = 158$)

The mass of ammonia in grams produced when 2.8 kg of dinitrogen quantitatively reacts with 1 kg of dihydrogen is _____.

The number of chiral centres present in [B] is _____.



Q48 Applications of Derivatives

[Step-by-step solution](#) › [prepwiser.in/questions/SS-L2bChnh](https://www.prepwiser.in/questions/SS-L2bChnh)

Let f be a twice differentiable function on $(1, 6)$. If $f(2) = 8$, $f'(2) = 5$, $f'(x) \geq 1$ and $f''(x) \geq 4$, for all $x \in (1, 6)$, then:

- (A) $f(5) \leq 10$ (B) $f(5) + f'(5) \geq 28$ (C) $f(5) + f'(5) \leq 26$ (D) $f'(5) + f''(5) \leq 20$

Q49 Binomial Theorem

[Step-by-step solution](#) › [prepwiser.in/questions/cMXKrA6Q07](https://www.prepwiser.in/questions/cMXKrA6Q07)

The value of $\sum_{r=0}^{20} {}^{50-r}C_6$ is equal to:

- (A) ${}^{50}C_6 - {}^{30}C_6$ (B) ${}^{51}C_7 - {}^{30}C_7$ (C) ${}^{50}C_7 - {}^{30}C_7$ (D) ${}^{51}C_7 + {}^{30}C_7$

Q50 Complex Numbers

[Step-by-step solution](#) › [prepwiser.in/questions/mE7Gw91KzA](https://www.prepwiser.in/questions/mE7Gw91KzA)

Let $u = \frac{2z+i}{z-ki}$, $z = x + iy$ and $k > 0$. If the curve represented by $\text{Re}(u) + \text{Im}(u) = 1$ intersects the y -axis at the points P and Q where $PQ = 5$, then the value of k is:

- (A) 2 (B) 4 (C) $1/2$ (D) $3/2$

Q51 Definite Integration

[Step-by-step solution](#) › [prepwiser.in/questions/sqwo7jqes](https://www.prepwiser.in/questions/sqwo7jqes)

Let $f(x) = |x - 2|$ and $g(x) = f(f(x))$, $x \in [0, 4]$. Then

$\int_0^3 (g(x) - f(x))dx$ is equal to:

- (A) 1 (B) 0 (C) $\frac{1}{2}$ (D) $\frac{3}{2}$

Q52 Differential Equations

[Step-by-step solution](#) › [prepwiser.in/questions/P9l9AsPev5](https://www.prepwiser.in/questions/P9l9AsPev5)

Let $y = y(x)$ be the solution of the differential equation,

$xy' - y = x^2(x \cos x + \sin x)$, $x > 0$. If $y(\pi) = \pi$ then

$y''\left(\frac{\pi}{2}\right) + y\left(\frac{\pi}{2}\right)$ is equal to:

- (A) $1 + \frac{\pi}{2}$ (B) $2 + \frac{\pi}{2} + \frac{\pi^2}{4}$ (C) $2 + \frac{\pi}{2}$ (D) $1 + \frac{\pi}{2} + \frac{\pi^2}{4}$

Q53 Differentiation

[Step-by-step solution](#) › [prepwiser.in/questions/puaJFpY7OM](https://www.prepwiser.in/questions/puaJFpY7OM)

If

$$(a + \sqrt{2}b \cos x)(a - \sqrt{2}b \cos y) = a^2 - b^2$$

where $a > b > 0$, then $\frac{dx}{dy}$ at $\left(\frac{\pi}{4}, \frac{\pi}{4}\right)$ is:

- (A) $\frac{a-2b}{a+2b}$ (B) $\frac{a-b}{a+b}$ (C) $\frac{a+b}{a-b}$ (D) $\frac{2a+b}{2a-b}$

Q54 Ellipse

[Step-by-step solution](#) › [prepwiser.in/questions/Nbkxr6LTJk](https://www.prepwiser.in/questions/Nbkxr6LTJk)

Let $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ ($a > b$) be a given ellipse, length of whose latus rectum is 10. If its eccentricity is the maximum value of the function,

$\phi(t) = \frac{5}{12} + t - t^2$, then $a^2 + b^2$ is equal to:

- (A) 145 (B) 126 (C) 135 (D) 116

Q55 Hyperbola[Step-by-step solution](#) > [prepwiser.in/questions/MGF2uF8mDn](https://www.prepwiser.in/questions/MGF2uF8mDn)

Let $P(3, 3)$ be a point on the hyperbola,

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. If the normal to it at P intersects the x -axis at $(9, 0)$ and e is its eccentricity, then the ordered pair (a^2, e^2) is equal to:

- (A) $\left(\frac{9}{2}, 2\right)$ (B) $\left(\frac{3}{2}, 2\right)$ (C) $(9, 3)$ (D) $\left(\frac{9}{2}, 3\right)$

Q56 Matrices[Step-by-step solution](#) > [prepwiser.in/questions/hn0wDp-Nju](https://www.prepwiser.in/questions/hn0wDp-Nju)

If

$$A = \begin{bmatrix} \cos \theta & i \sin \theta \\ i \sin \theta & \cos \theta \end{bmatrix}$$

, $\left(\theta = \frac{\pi}{24}\right)$

and $A^5 = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, where $i = \sqrt{-1}$ then which one of the following is not true?

- (A) $a^2 - c^2 = 1$ (B) $0 \leq a^2 + b^2 \leq 1$ (C) $a^2 - d^2 = 0$ (D) $a^2 - b^2 = \frac{1}{2}$

Q57 Quadratic Equations & Polynomial Inequalities[Step-by-step solution](#) > [prepwiser.in/questions/A60Il2kR0z](https://www.prepwiser.in/questions/A60Il2kR0z)

Let α and β be the roots of $x^2 - 3x + p = 0$ and γ and δ be the roots of $x^2 - 6x + q = 0$. If $\alpha, \beta, \gamma, \delta$ form a geometric progression. Then ratio $(2q + p) : (2q - p)$ is:

- (A) 9 : 7 (B) 5 : 3 (C) 3 : 1 (D) 33 : 31

Q58 Relations & Functions (Basic)[Step-by-step solution](#) > [prepwiser.in/questions/jNOT6ghoIt](https://www.prepwiser.in/questions/jNOT6ghoIt)

Let $[t]$ denote the greatest integer $\leq t$. Then the equation in x , $[x]^2 + 2[x+2] - 7 = 0$ has:

- (A) no integral solution. (B) exactly two solutions.
(C) exactly four integral solutions. (D) infinitely many solutions.

Q59 Sequences & Series[Step-by-step solution](#) > [prepwiser.in/questions/DiHcc6Owb4](https://www.prepwiser.in/questions/DiHcc6Owb4)

If $1 + (1-2^2.1) + (1-4^2.3) + (1-6^2.5) + \dots + (1-20^2.19) = \alpha - 220\beta$, then an ordered pair (α, β) is equal to:

- (A) $(11, 103)$ (B) $(10, 103)$ (C) $(10, 97)$ (D) $(11, 97)$

Q60 Sets[Step-by-step solution](#) > [prepwiser.in/questions/pIZY3CmQTH](https://www.prepwiser.in/questions/pIZY3CmQTH)

A survey shows that 63% of the people in a city read newspaper A whereas 76% read newspaper B. If $x\%$ of the people read both the newspapers, then a possible value of x can be:

- (A) 37 (B) 65 (C) 29 (D) 55

Q61 Statistics[Step-by-step solution](#) > [prepwiser.in/questions/m9I9_UyC6y](https://www.prepwiser.in/questions/m9I9_UyC6y)

The mean and variance of 8 observations are 10 and 13.5, respectively. If 6 of these observations are 5, 7, 10, 12, 14, 15, then the absolute difference of the remaining two observations is:

- (A) 5 (B) 3 (C) 7 (D) 9

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Let x_0 be the point of Local maxima of

$$f(x) = \vec{a} \cdot (\vec{b} \times \vec{c})$$

, where

$\vec{a} = x\hat{i} - 2\hat{j} + 3\hat{k}$, $\vec{b} = -2\hat{i} + x\hat{j} - \hat{k}$, $\vec{c} = 7\hat{i} - 2\hat{j} + x\hat{k}$. Then the value of

$$\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}$$

at $x = x_0$ is:

(A) 14

(B) -30

(C) -4

(D) -22

Two vertical poles AB = 15 m and CD = 10 m are standing apart on a horizontal ground with points A and C on the ground. If P is the point of intersection of BC and AD, then the height of P (in m) above the line AC is:

(A) 10/3

(B) 5

(C) 20/3

(D) 6

The integral $\int \left(\frac{x}{x \sin x + \cos x} \right)^2 dx$ is equal to (where C is a constant of integration):

(A) $\sec x - \frac{x \tan x}{x \sin x + \cos x} + C$

(B) $\sec x + \frac{x \tan x}{x \sin x + \cos x} + C$

(C) $\tan x - \frac{x \sec x}{x \sin x + \cos x} + C$

(D) $\tan x + \frac{x \sec x}{x \sin x + \cos x} + C$

Let $f(x) = \int \frac{\sqrt{x}}{(1+x)^2} dx$ ($x \geq 0$). Then $f(3) - f(1)$ is equal to:

(A) $-\frac{\pi}{12} + \frac{1}{2} + \frac{\sqrt{3}}{4}$

(B) $\frac{\pi}{12} + \frac{1}{2} - \frac{\sqrt{3}}{4}$

(C) $-\frac{\pi}{6} + \frac{1}{2} + \frac{\sqrt{3}}{4}$

(D) $\frac{\pi}{6} + \frac{1}{2} - \frac{\sqrt{3}}{4}$

Mathematics Section B · Numerical value

Q66 to Q70

If the equation of a plane P, passing through the intersection of the planes, $x + 4y - z + 7 = 0$ and $3x + y + 5z = 8$ is $ax + by + 6z = 15$ for some $a, b \in \mathbb{R}$, then the distance of the point (3, 2, -1) from the plane P is.....

Let $(2x^2 + 3x + 4)^{10} = \sum_{r=0}^{20} a_r x^r$

Then $\frac{a_7}{a_{13}}$ is equal to ____.

Suppose a differentiable function $f(x)$ satisfies the identity

$$f(x+y) = f(x) + f(y) + xy^2 + x^2y, \text{ for all real } x \text{ and } y.$$

$\lim_{x \rightarrow 0} \frac{f(x)}{x} = 1$, then $f'(3)$ is equal to ____.

If the system of equations

$$x - 2y + 3z = 9$$

$$2x + y + z = b$$

$$x - 7y + az = 24,$$

has infinitely many solutions, then $a - b$ is equal to.....

The probability of a man hitting a target is $\frac{1}{10}$. The least number of shots required, so that the probability of his hitting the target at least once is greater than $\frac{1}{4}$, is _____.

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Physics

1. D	2. C	3. D	4. C	5. A	6. C	7. D	8. B
9. C	10. C	11. B	12. C	13. D	14. B	15. C	16. D
17. B	18. B	19. A	20. 6	21. 267	22. 20		

Chemistry

23. A	24. D	25. C	26. D	27. C	28. A	29. A	30. D
31. B	32. D	33. A	34. D	35. A	36. D	37. C	38. C
39. A	40. A	41. C	42. C	43. 60	44. 600	45. 85	46. 3400
47. 4							

Mathematics

48. B	49. B	50. A	51. A	52. C	53. C	54. B	55. D
56. D	57. A	58. D	59. A	60. D	61. C	62. D	63. D
64. C	65. B	66. 3	67. 8	68. 10	69. 5	70. 3	

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